DCF Valuation of Companies: Exploring the Interrelation Between Revenue and Operating Expenditures

Dimiter Nenkov[*], Yanko Hristozov[**]

Abstract

This research explores some key aspects of the application of the DCF enterprise valuation model. The fundamental problems related to determining the value of companies are also discussed in a broader sense. The focus is on the analysis of the key input variables that determine the operating free cash flows. This is a particularly important part of the application of DCF valuation models because this is where the most serious prerequisites for deviating forecasts from reality are. This often leads to significant distortions in the final estimates.

In this regard, a more in-depth study of the interdependence between the five main input variables, and in particular between revenues on the one hand and different groups of expenditures on the other, is needed. In this case specifically, the relationship between operating revenue and operating expenses was studied on the basis of summary data for all non-financial corporations in Bulgaria for the period 2008-2020. The results confirm the relationship between operating income dynamics and operating expenses dynamics in the medium and long term. This is a good argument that forecasting operating costs based on their historical averages as a percent of operating income is justified.

1. Introduction

Economic theory and practice provide ample evidence of the complexity and problems associated with determining the value of enterprises and their common stock. This is the leading reason for the special attention paid to valuation issues. Each valuation of an ordinary share is accompanied by a degree of uncertainty, of doubt about the final price received, both by the users of the respective valuation and by valuators themselves, no matter how good and experienced they are. Very often, the end result is not even an exact price, but a price range within which the actual value of the subject company is expected to vary.

The main reason for this is that none of the known and used valuation approaches and methods is good enough. Each of them has its

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[*] Prof. Dr., University of National and World Economy, dnenkov@unwe.bg
[**] Assoc. Prof. Dr., University of National and World Economy, yankohristozov@unwe.bg

weaknesses and shortcomings, which reduces confidence in the end result. It is this fact that makes the assessment of complex assets, such as enterprises, particularly challenging and more difficult. This requires a more in-depth study of the individual components of the various valuation methods, or at least those that are defined as contemporary and most promising. The DCF enterprise valuation model is traditionally considered to be such a model, which only emphasizes the *relevance* of the present study.

The *objective* of this study is to explore and possibly improve the reliability of forecasting future operating free cash flows based on publicly available data from companies' financial statements. The *object* of the research is the DCF enterprise valuation model. The *subject* of the research is the determination of the operating free cash flows for the needs of the model.

The *main hypothesis* is that there is a significant interdependence between the main input variables for determining operating free cash flows, which should be used in their forecasting within the application of the DCF enterprise valuation model.

2. Value of companies and fundamental problems of its measurement

Fair value concept is widely used in DCF business valuation (Mielcarz, Wnuczak, 2011). For common equity investors, as well as for fundamental analysts, determining the true value of companies is paramount. Investors in this case are considered those participants in the stock market who meet the definition of Benjamin Graham and David Dodd. These are the two authors of Security Analysis, the first book of its kind of 1934, which many say gave rise to the modern analysis of stocks

and other financial assets. They use the term "investor" as opposed to the term "speculator" (Graham, Dodd, 2009). According to them, the investment is an operation in which, on the basis of a comprehensive and in-depth analysis, the preservation of the principal is guaranteed, and an adequate return is realized. Operations that do not meet these requirements are speculative (Graham, 2006, Moris, C., 2009). The in-depth analysis of the respective financial asset, which the authors have in mind, is essentially dedicated to determining its actual value. The primary objective of financial managers is commonly defined through their role in maximizing the wealth of shareholders in the long term (Raykov, E., 2017). The ability of a company to generate profit for its investors is key to its long-term performance, sustainability and competitive position (Kostov, I., 2022).

However, the evaluation of companies by investors and analysts is a serious challenge and is almost always more difficult. The main reason is that the value sought in the valuation process is hidden and invisible. Precisely due to the lack of a reliable way for its direct calculation, it is necessary to indirectly determine it on the market through the prices of assets.

However, asset prices may at any time deviate more or less from their intrinsic value due to supply and demand or other factors. Another common problem is that the company in question may not even be present on the organized capital market (it is not public) and there is no price formed on the market.

According to one widely accepted definition, the *value* of a company (and its stocks) in general, is the price recognized in an arm's-length transaction by a free market, in the conditions of equilibrium between supply and demand, when buyer and seller have

the necessary information for this company, when buyer and seller act rationally, when buyer and seller act without coercion (Zukin, J., 1990, International Valuation Standards Council, 2011).

In other words, it is the job of the market to determine the value of stocks. However, the definition clearly implies that the price awarded by the market to a common stock is supposed to represent its true value only if a number of conditions are met. These include:

- a free market;
- equilibrium between supply and demand;
- buyer and seller have the necessary information;
- buyer and seller act rationally;
- buyer and seller act without coercion;
- … (the list of conditions could eventually be continued).

If one or more of the above conditions are not met, this is a prerequisite for the market price of a stock to deviate from its actual value. Most people, involved in the activities and processes of the stock market, would agree that in reality these conditions are almost never met at 100%, even in the most efficient capital markets. The less these conditions are met, the higher would the difference between price and value (the value gap) be. This explains why the market itself also periodically fails in determining the true value of stocks. This is why significant efforts and costs are made by many analysts and investors for parallel, independent valuation of stocks (Nenkov, D., 2021).

In other words, the *market price* will express the *actual value* only in an ideal situation on a completely free market, of balance, equality and awareness. In a dynamic economic environment, such ideal situations, in which intrinsic value and market price coincide, do not last long. And in the conditions of emerging capital markets such as Bulgaria, they are rather exceptions. This underlines the need for a targeted stakeholder valuation process. This process is more or less subjective in nature, and the price obtained could be defined as "theoretical value" or "theoretical price", claiming to reflect the actual value of the company. The extent to which the theoretical price thus obtained will approach the actual value depends mainly on the quality and durability of the evaluation process, the evaluation approaches and methods and their application (Nenkov, D., 2005).

3. Main approaches for valuation and the place of the DCF enterprise model

The classifications of approaches, methods and models for valuation of enterprises are very diverse and numerous (Zukin, J., 1990, Damodaran, A., 2012, Copeland, T., Antikarov, V., 2001). Despite this diversity, however, they all have some recurring, common characteristics. The common denominator comes from the fact that the value of a company can be derived departing from three possible starting points. These are actually the three main groups of factors that determine the price of an enterprise (Guevski, I., 2001):

- Type and condition of the assets of the enterprise, incl. operating assets and non-operating assets;
- Expected financial benefits (income, cash flows) for owners in the form of cash flow from operating activities, dividends, mortgage proceeds, proceeds from liquidation of assets, proceeds from sale of shares, etc.;
- Market price of already sold similar enterprises.

On this basis, three main approaches to valuation are formed (Nenkov, D., 2005),

which are referred to under different names in different classifications and in the standards for business valuation:

- Asset-based approach;
- Income-based approach;
- Market comparisons approach.

In the first case, we start from the assets. This is logical insofar as they are a kind of carrier of the value of the enterprise. In the second case, the starting point is the expected income, i.e., from the company's potential to bring income to its owners. It is no coincidence that the methods of this approach are among the most recommended because they are aimed directly at the sources of value of companies and their shares, i.e., to expected income (Becker Professional Education, 2015). In the third case, the price paid by the market for such enterprises is examined and, on this basis, the value (or rather the price) of the assessed enterprise is indirectly derived.

Each of the three approaches is applied through a set of specific methods and models. None of the approaches, with their inherent methods and models, is flawless in the process of finding the true value of the companies being valued. Each has its advantages and disadvantages, each is accompanied by certain limitations and difficulties, which ultimately call into question the reliability of the final result of the evaluation - the calculated value. In this regard, to clarify the place and importance of each of the approaches in the process of evaluating entire enterprises, it is especially important to be aware of their relative advantages, disadvantages and limitations.

The main advantage of the income-based approach is that its methods are aimed directly at the very sources of value of the assessed assets - the future income from their use. It is the future effects that are the basis of the

determined theoretical price of assets in this approach. In this sense, we can say that the methods of this approach consider to a very high extent the purpose of any investment - to obtain higher value in the future.

The main criticism of this approach is related to the need to anticipate future cash flows and then convert them into current money through discounting. Both processes are subject to a number of subjective assumptions and related possible deviations from reality. These shortcomings of income methods are particularly pronounced in conditions of high inflation and uncertainty.

The two main methods within the income-based approach are the *Discounted cash flow method* and the *Income capitalization method*. Both methods are designed to determine the present value of the expected future income (cash flows) from the operation of the assessed entity. In modern practice, the two methods are applied in combination, using a set of specific models. These include (Reilly, Brown, 2003):

- Dividend discount model – DDM;
- DCF equity valuation model;
- Adjusted present value model – APV (Damodaran, A., 2012);
- DCF enterprise valuation model;
- Economic profit model (Economic value-added model) (Copeland, T., Koller, T., Murrin, J., 2000);
- Models based on real options (Copeland, T., Antikarov, V., 2001).

4. DCF enterprise valuation model – general concepts and problems of its application

The DCF enterprise valuation model assumes that the companies being valued will continue to operate in the future, ideally until infinity. According to various studies, it is

one of the most widely used valuation models (Bancel, Mittoo, 2014), along with market comparison methods (Fernandez, 2019). As its name suggests, it is used to determine the value of the enterprise as a whole. Since the carrier of this value is its assets, the model actually determines the value of the assets. In other words, this model determines the value deriving from the activity of the enterprise, or the so-called value of the whole enterprise, which belongs to the two main groups of investors in the same enterprise - owners (shareholders) and creditors. The second group includes the holders of the company's interest-bearing debt. Once it has determined the value of the entire enterprise arising from its activities, the model makes it possible to determine the value of equity by subtracting the value of interest-bearing debt and any other liabilities, such as the value of preferred shares (Pinto, J, Henry, E., Robinson, T., Stowe, J., 2010). Thus, it becomes clear what price is worth paying for the equity as a whole, for an ordinary share, respectively for the majority stake, giving the right to actual management of the company's assets (O'Brien, T., 2003).

The model is based on future expected free cash flows to the firm (FCFF) and their discounting to the current moment. The operating value of the enterprise is determined as the sum of the discounted operating free cash flows to the firm (FCFF). To this value is added the value of non-operating assets to obtain the value of the enterprise as a whole. The value of the interest-bearing debt is deducted from it in order to obtain the value of the equity, and subsequently the value of an ordinary share.

The correct application of the DCF enterprise model requires solving three sets of problems (Nenkov, D., 2015):

- To correctly determine the free operating cash flows to the firm (FCFF);
- To determine the right discount rate for these cash flows;
- To find an appropriate solution in connection with the foreseen indefinitely long period of operation of the business.

The steps for the application of the DCF enterprise valuation model can be arranged in different ways (Patena, W., 2011). One of them is as follows:

Step 1: Determine the expected operating free cash flows.

Step 2: Determine the discount rate. (This is the WACC, because the valuation is at the invested capital level, and the discounted cash flows are to all investors.)

Step 3: Determine the continuing (terminal) value (CV, TV).

Step 4: Determine the operating value of the company.

Step 5: Determine the value of the company as a whole.

Step 6: Determine the value of equity and the value per share.

The current study focuses only on Step 1 - the problems associated with determining the expected free operating cash flows for the company. This is the most time-consuming and at the same time the most challenging part of the valuation through the DCF enterprise model. In terms of difficulty, only Step 2 - Determining the discount rate, can compete with it. In these two aspects are the most common weaknesses and errors leading to deviations in the final value. With regard to this, Pablo Fernandez and Andrada Bilan present a long list of typical omissions and errors in the process of applying the main evaluation methods and models. In their publication "110 Common Errors in Company Valuations", they talk about the large number

of errors that accompany the application of various valuation methods and models (Fernandez, P., Bilan, A., 2007). Many of them refer to gaps in the DCF enterprise valuation model.

Another widely used term for the intrinsic value of a company is the term *fundamental value*. Defining it as the present value of the expected free cash flows is in fact an application of the so-called fundamental approach, or fundamental analysis. In other words, the DCF enterprise valuation model is simply a variant of the application of fundamental analysis. In this regard, in any such assessment, it is important to keep in mind that according to the concept of the fundamental approach, the value of each company is a function of three *fundamentals*. It depends on these three fundamentals whether the company will be of high or low value. Again, it depends on them whether a company creates value or destroys value. The three fundamentals are (Damodaran, A., 2012):

- The earnings potential (cash-flow potential);
- Growth of earnings (of cash flows);
- Risk.

The value of the company is directly proportional to the first and second fundamentals and inversely proportional to the third fundamental. That is, the greater the potential for generating income (profit), the higher the value of the company. The higher the growth of income (profit), the higher the value. The higher the company's risk, the lower is its value.

Thus, in the end, the most sensitive part of the application of the DCF enterprise model is related to the efforts to consider these three fundamentals and to predict their specific impact. The indicators of each of the three fundamentals, which are suitable for use in the context of the DCF enterprise model, are as follows:

- For the earnings potential: *Return on invested capital (ROIC)*. It demonstrates the potential of the company to generate profit (income) per unit of invested capital. The indicator represents the ratio between net operating profit and invested capital. This coefficient is a relative indicator and makes it possible to compare the earnings potential of different companies, regardless of their size.
- For the growth of earnings: *The growth rate of NOPAT – g*. It shows the growth of profit and of cash flows.
- For the risk: *Weighted average cost of capital*. It is the appropriate expression of the level of risk of the company because it contains the risk premium. The higher the risk of the company, the higher is its WACC, and vice versa.

The importance of the three fundamentals becomes evident after having a closer look at the scheme for deriving of the operating free cash flow (FCFF), as presented in Table 1. As seen from the scheme, the free cash flow is a residual value. The first type of expenditures that are deducted from revenue are the operating expenditures (less D&A). The D&As are deducted separately after that, being a specific type of expenditures. They are only accounting costs, non-cash charges, or so-called quasi costs (Pinto, J, Henry, E., Robinson, T., Stowe, J., 2010). The next step is to determine and to deduct the fiscal expenditure – this is the corporate tax (row 6 of the scheme).

Table 1. Simple scheme for determining the Operating free cash flow (FCFF)

Row	Position
1. 2.	Operating revenue - Operating expenditures (less D&A)
3. 4.	= EBITDA (Earnings before interest, tax, depreciation and amortization) - Depreciation and amortization (D&A)
5. 6.	**= EBIT (Operating profit before tax)** - Corporate tax (on EBIT)
7. 8.	**= Net operating profit after tax (NOPAT)** + Depreciation and amortization (D&A)
9.	**= Gross cash flow (r.7 + r.8)**
10. 11.	Increase of Net Operating Working Capital (NOWC) + Capital expenditures (investments in non-current assets)
12.	**= Gross investments (r.10 + r.11)**
13.	**= Operating free cash flow (FCFF) (r.9 – r.12)**

It is noteworthy that interest on debt is not deducted in this scheme, which means that the tax effect of recognizing interest as expenses is ignored. The reason for not taking out interest expenses is that under the DCF enterprise model free cash flows to all groups of investors are determined, not only to shareholders. No cash flows connected with financing, including interest on debt, are considered. At the same time no revenue from sources, other than company's operations, are considered either, such as interest income or other financial income. The justification for ignoring the tax shield on interest is that this tax shield effect is accounted for in the WACC, which is used as the discount rate for the future operating free cash flows (Koller, T., Goedhart, M., Wessels, D., 2015). Eventual accounting of this effect when determining the free cash flows would lead to double counting of one and the same effect (Nenkov, D., 2015). A similar approach is applied when determining the net operating cash flows for the assessment of capital-investment projects. It is about the so called by Aleksandrova "second variant of calculating of net cash flows from the operation of investment sites" (Aleksandrova, M., 2012).

After deducting the corporate tax, the net operating profit (NOPAT) is determined (on row 7). For the reasons stated, the net operating profit thus obtained is not limited to the shareholders. It is at the level of invested capital, i.e., for all investors. The next step is to add the depreciation and amortization back to NOPAT to get the gross cash flow (on row 9). It should be noted that this scheme in all cases involves only tax-deductible depreciation and amortization. D&A is added back because, as mentioned, they are not an actual (monetary) expense for the company and remain in it as a source of investment financing. The resulting gross cash flow is not yet the final flow needed for the model. It is often called operating cash flow and represents the total amount of money that a company derives from its operations. One of its main purposes is to serve as a source of financing new investments in business, instead of having to rely on external capital.

The next step is to deduct one more type of expenditures – these are the investment

expenditures for the respective year. They are equal to the gross investments at row 12 of the scheme and are equal to the sum of the two groups of investment expenditures:

- Increase of the net operating working capital – NOWC (row 10). This increase is the result of investments in current operating assets;
- Capital expenditures - CAPEX (row 11). These are the investments for acquiring non-current assets.

After deducting gross investments from gross cash flow, free operating cash flows (FCFF) are obtained. The scheme presented in this way can be applied both historically - in relation to the past period of the company's operations, and for future periods. This second aspect is the most important insofar as future free operating cash flows are needed to determine operating value. This requires forecasting future revenues, as well as different types of expenses.

One way to do this is to directly forecast future sales of individual products that are planned for production. For this purpose, the volume of the market, the market share that will be occupied by the valued company and the unit price of the product are forecasted. Variable and fixed costs related to the production and sale of individual products are also calculated. The costs for administration and management are reflected. The procedure for determining changes in current assets and net working capital, as well as in determining capital expenditures, is followed in a similar direct way. This course of action presupposes detailed and accurate inside information and can be applied by the financial team of the assessed company or by trusted analysts engaged by it, to whom this information is provided.

However, modern DCF valuation models are also adapted to work on the basis of publicly available information only (Palepu, K., Healy, P., 2012). In fact, in the vast majority of cases, these models are applied based on public information. The main sources are the company's annual financial statements – for at least five, ten or more years backwards (Penman, S., 2013, Barker, R., 2001). A qualitative analysis of the data in them shows very well the performance of the company in the past and makes it possible to make reliable forecasts about future revenues and expenses. This opens up a wide opportunity for relatively accurate evaluation of companies "from outside", i.e., from outsiders without relying on inside information. The forecasts are a kind of extrapolation of key indicators from the annual financial statements, in the first place the *Income Statement (Statement of Comprehensive Income)* and the *Balance Sheet (Statement of Financial Position)*. Another advantage of this approach is that it "reproduces" future Income Statements s and Balance Sheets for the years of the explicit forecast period. The construction of future balance sheets, for example, gives an idea of how the different parameters are combined and how justified they are. It is possible to verify the reliability of the various assumptions and coefficients obtained by detecting certain items in the Income Statement, Balance Sheet and other statements.

The scheme for determining the operating free cash flow shows that it is actually dependent on the following 5 main input variables:

- Operating revenue;
- Operating expenditures (less D&A);
- D&A;
- Increase of net operating working capital;
- Capital expenditures.

Each of these variables must be forecasted for each year of the explicit forecast period, as well as for the first year after the end of the explicit forecast period. There is also a sixth input variable - the corporate tax rate, but it is usually not a challenge and does not need to be discussed in much detail here. The five variables are not completely independent, they are interconnected in a certain way. Forecasting each one on its own, inevitably leads to illogical future values and distorted free cash flows. This in turn leads to a highly distorted valuation of the company. The most important point here is to be logically consistent. To this end, it is important to study and know the relationships between the individual input variables. This is one of the main tasks of the present study.

One of the ways used to link the forecasts of the 5 input variables is by "tying" the four types of expenditures to the operating revenue. Thus, only one growth rate needs to be forecasted – the growth rate of revenue. For this purpose, it is necessary that each of the types of expenditures is expressed as a percentage of revenue. This is usually based on the historical average relative share of the corresponding expenditure to historical revenue. This is one of the important aspects in which the analysis of financial statements for a longer historical period is very useful. It would be even more useful to have information on how the respective types of expenditures correlate with revenue on the basis of a wider sample of companies, for example for the sector as a whole.

5. Empirical study of the relationship between operating revenue and operating expenditures (less D&A) of enterprises in Bulgaria

This empirical study is made in connection with the above approach of "tying" each of the four groups of expenditures to revenue, while trying to make projections of future operating free cash flows to the firm (FCFF). The main objective is to analyze the relationship between the dynamics of revenues, on one hand, and the dynamics of each of the four groups of expenditures, on the other hand. The study is made using a broad data base for all non-financial corporations (NFC) in Bulgaria. The database is prepared annually by the National Institute of Statistics (NIS) of the country, and previous studies in the field of financial management indicate that it is extremely appropriate and useful for this purpose (Hristozov, Y., 2021). The database itself includes the annual aggregate Comprehensive Income Statements and the aggregate Balance Sheets (Statements of Financial Position) by sectors of non-financial corporations in Bulgaria, for the period 2008-2020. In this database all non-financial enterprises in the country are grouped in 17 sectors – from A to S (not including K and O, which are financial). The 17 sectors are in accordance with the national classification, and are as follows:

A. Agriculture, Forestry and Fisheries
B. Mining Industry
C. Manufacturing Industry
D. Energy (Production and Distribution of Electricity and Heat, and Gaseous Fuels)
E. Water Supply, Sewerage, Waste Management and Remediation Activities
F. Construction
G. Trade; Repair of Motor Vehicles and Motorcycles

H. Transport, Warehousing and Postal Services

I. Hotels and Restaurants

J. Creation and Dissemination of Creative Products; Telecommunications

L. Real Estate Operations

M. Professional Activities and Research

N. Administrative and Support Service Activities

P. Education

Q. Human Health and Social Work

R. Culture, Sport and Entertainment

S. Other Activities

This research paper is specifically limited to analyzing the relationship between *operating revenue* and *operating expenditures (less D&A)*. The relationships between revenue and the other three types of expenditures will be subject to further studies by the authors. Given the fact that the study is related to the DCF valuation of enterprises, which are business entities, it is important to note that some of the sectors consist predominantly of non-business entities. This should refer mainly to sectors from M to S. The organization of these types of activities in Bulgaria suggests that they are concentrated mainly in public institutions and entities, most of which are different from the typical for-profit business enterprises. For this reason, more attention is given to the first 11 sectors – from A to L. The 5 largest sectors in terms of turnover are: sector G (Trade; +), followed by sector C (Manufacturing), sector F (Construction), sector H (Transport, +), sector D (Energy).

As outlined in the previous section, one of the approaches to making projections about future operating expenditures is by expressing them as a percentage of operating revenue on the basis of historic average ratios between these two variables. The rationale behind our expectations that operating expenditures will move in line with operating revenue, is that both of them are the function of the annual amount of production and sales.

5.1. Observation of the dynamics of operating revenue and operating expenditures (less D&A)

Figure 1 illustrates the dynamics by years of the aggregate operating revenue and operating expenditures (less D&A) for all sectors. The operating expenditures follow closely the dynamics of operating revenue. The number of enterprises included in the database increases most of the time. This distorts the actual growth rates of both revenue and expenditures, but it actually does not affect the comparison between them. The subject of interest here is the behavior of these two indicators in relative terms, which is how expenditures move compared to revenue.

According to the figures by sectors, both values move more or less together, as a mid-term trend, for most of the sectors. Figures 2, 3, 4, 5 and 6 illustrate the dynamics by years of operating revenue and operating expenditures (less D&A) for each of the 5 largest sectors (in terms of revenue) respectively, including: G, C, F, H, D. Common trends of the two variables are observed, with the curves of operating expenditures (less D&A) following closely the curves of operating revenue. If there are minor discrepancies, they are on an annual basis, but in terms of general trends over the period as a whole, changes in expenditures follow changes in revenue. The observed period (2008-2020) starts with the years of the global financial crisis and ends with the Covid-19 pandemic crisis. Even in the most turbulent years, the two variables make quite similar moves.
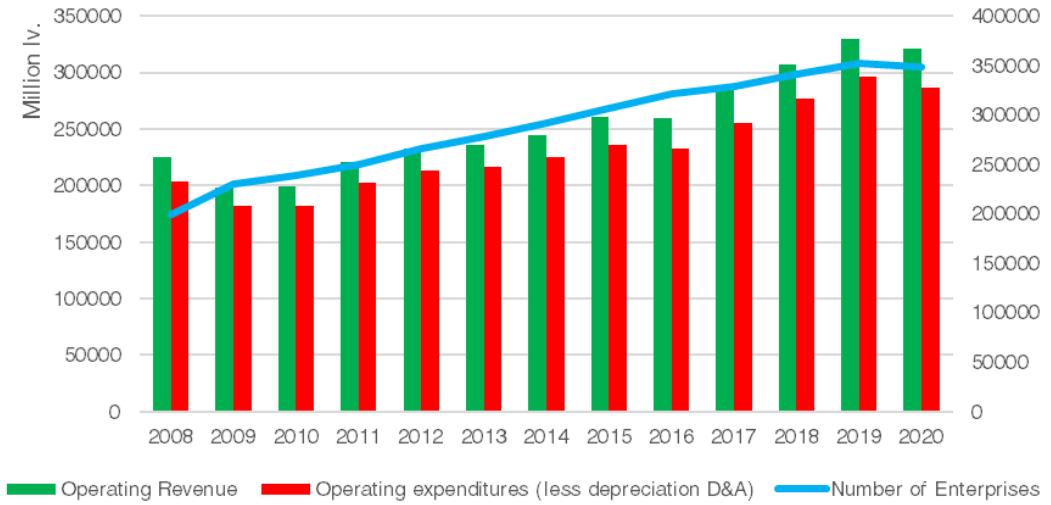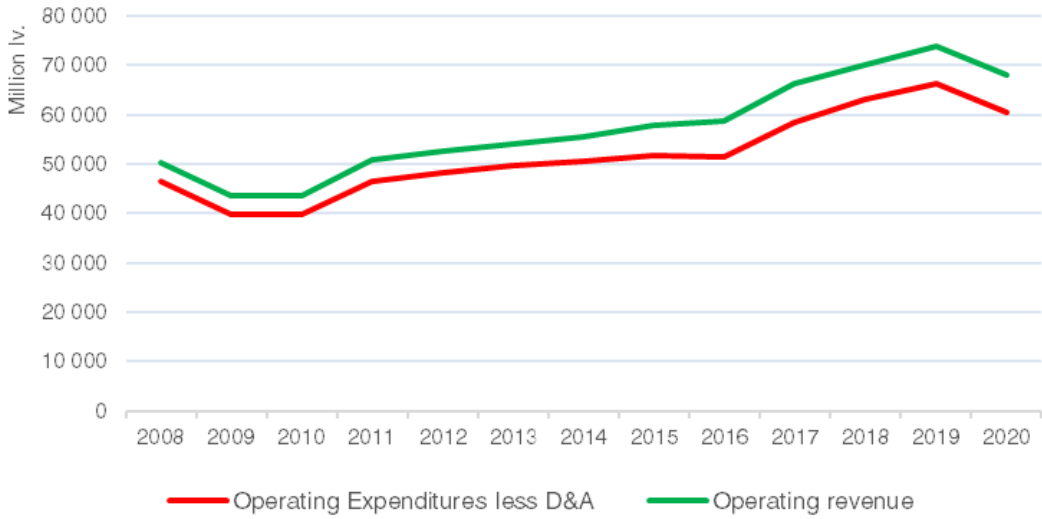
Figure 1. Total Revenue and Operating Expenditures of NFC in Bulgaria
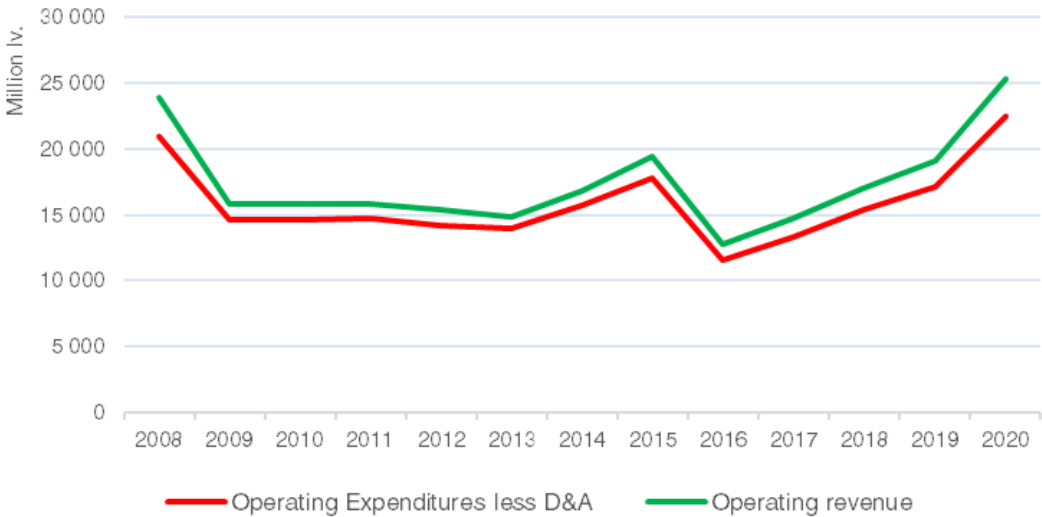**Source:** National Institute of Statistics, Own analysis
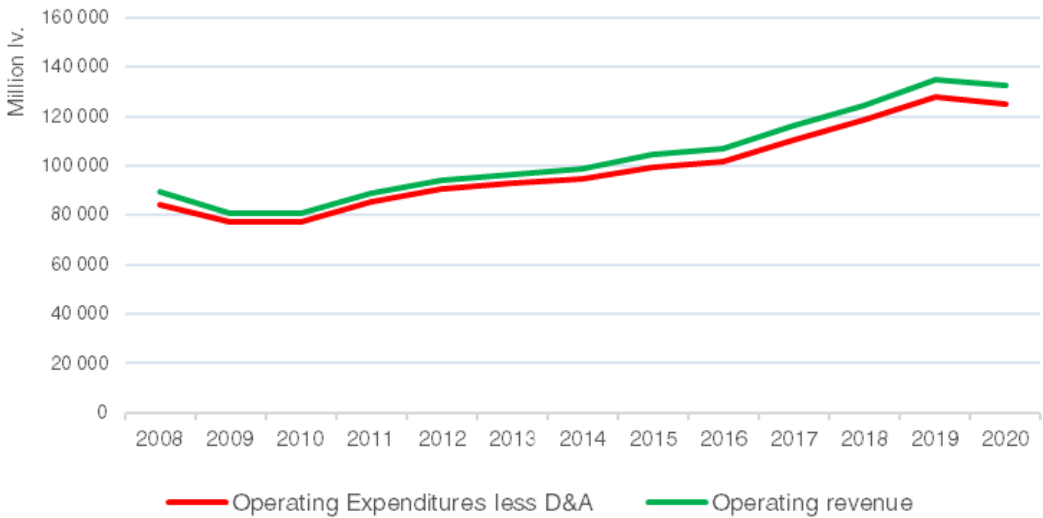
Figure 2. Sector G - Trade; ...
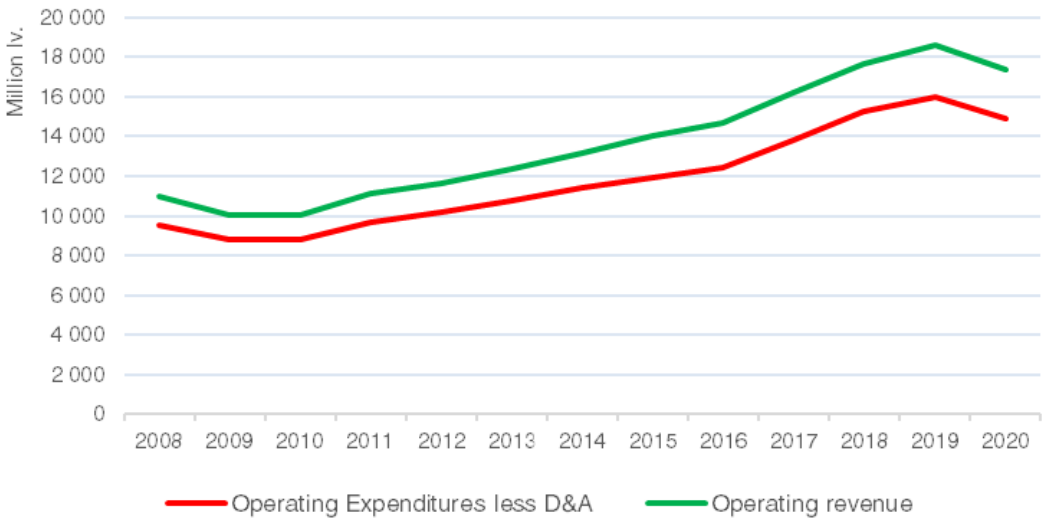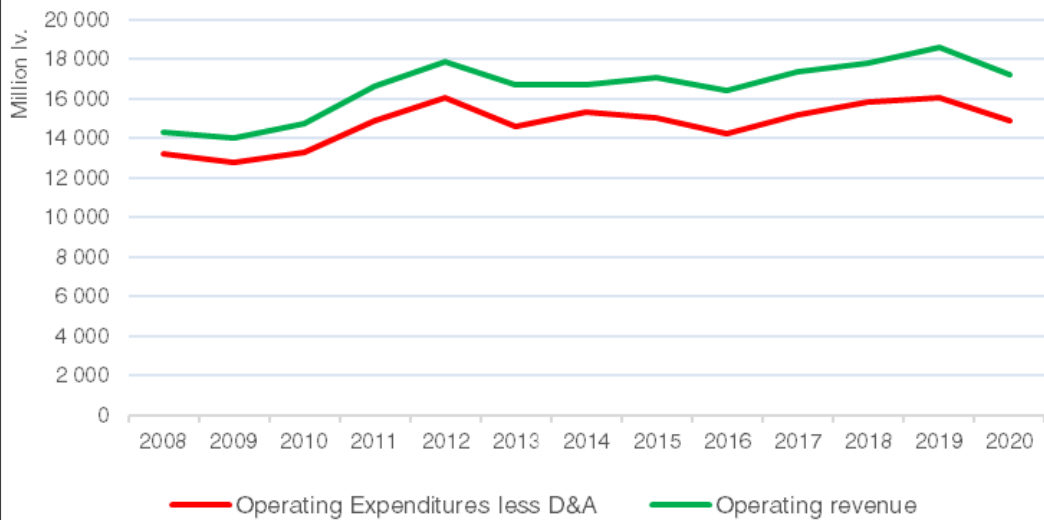**Source:** National Institute of Statistics, Own analysis

Figure 3. Sector C - Manufacturing
Source: National Institute of Statistics, Own analysis.

Figure 4. Sector F - Construction
Source: National Institute of Statistics, Own analysis

Figure 5. Sector H - Transport, ...
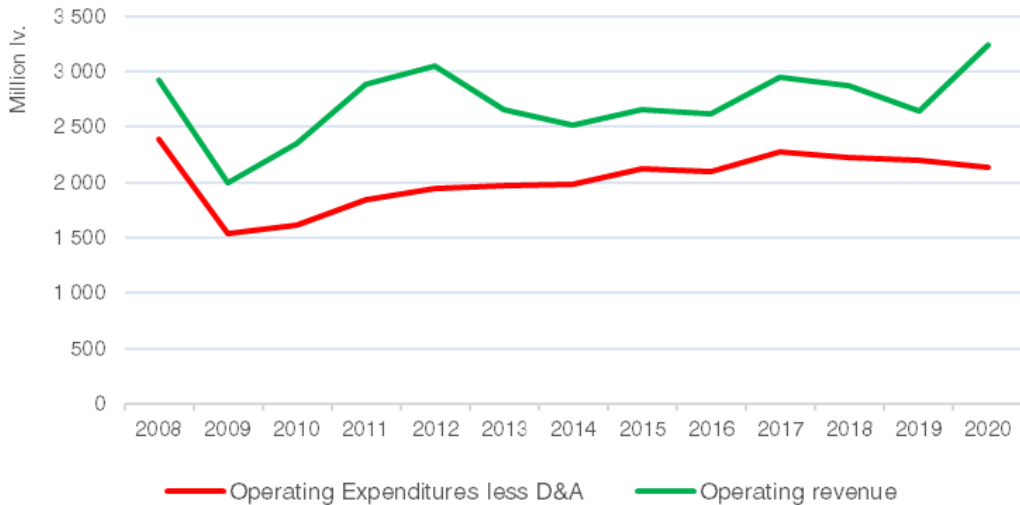**Source:** National Institute of Statistics, Own analysis

Figure 6. Sector D - Energy
Source: National Institute of Statistics, Own analysis

There are also some sectors, for which no joint movement of the two curves is observed. One example is sector B (Mining), where the volatility of operating revenue is much higher and is not followed by operating expenditures (less D&A), the curve of which is much smoother. This is most likely due to the strong volatility of prices of metals and other fossil resources. Another reason for this could also be the high level of fixed costs in this sector. This is illustrated in Figure 7. Even in this case, however, the

general trend of revenue is followed by expenditures (less D&A). In other words, if projections of future expenditures for the sector are tied to the projected average growth of revenue, this could still be a very good approximation.

Figure 7. Sector B - Mining
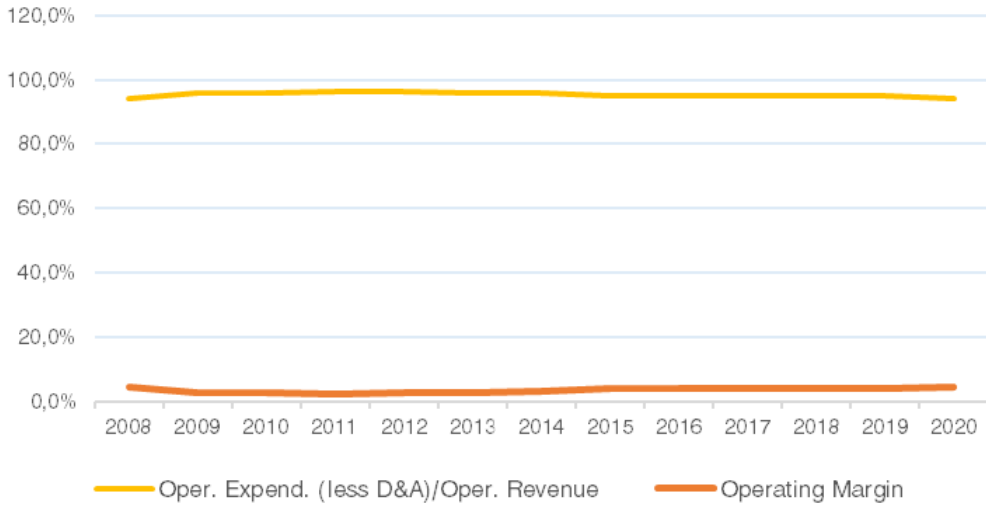**Source:** National Institute of Statistics, Own analysis

5.2. Observation of the operating margin and of the operating expenditures (less D&A) as a proportion of operating revenue

The next few figures (8,9,10,11, and 12) illustrate operating expenditures (less D&A), expressed as a percentage of operating revenue for the observed period 2008-2020. The figures also illustrate the operating margin, which is directly dependent on the percentage of costs and the percentage of D&A. The figures contain data about the same 5 largest sectors, presented again in order of size: G, C, F, H, D.

These figures are even more important than the ones discussed in the previous sub-section, since they express operating expenditures (less D&A) exactly in the way they are included in the model for forecasting their future values. Another advantage is that they show the operating margin – one of the two key indicators, together with growth rate, which are intensively used in the forecast of future operating free cash flows under the DCF enterprise valuation model.

Figure 8. Sector G - Trade; ...
Source: National Institute of Statistics, Own analysis

The two lines in Figure 8 (sector G – Trade, & …), are horizontal and smooth, with relatively small deviations from the straight line. The deviations from the mean are within a small range (Table 3). The lines are quite similar in figure 10 (sector H – Transport, …) – almost horizontal and smooth. These figures indicate for relatively stable proportions of operating expenditures (less D&A) towards revenue in the mid-term.
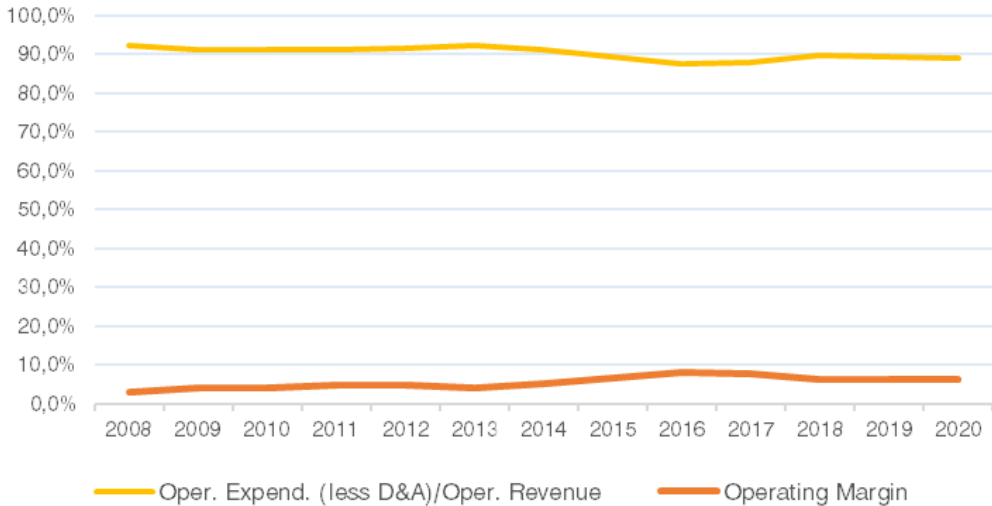

Figure 9. Sector C - Manufacturing
Source: National Institute of Statistics, Own analysis

The lines in figures 9 (Sector C - Manufacturing) and 11 (Sector F - Construction), are also smooth, but they have a slight trend of decreasing of operating expenditures (less D&A) in relative terms, respectively a slightly increasing operating margin over the period.
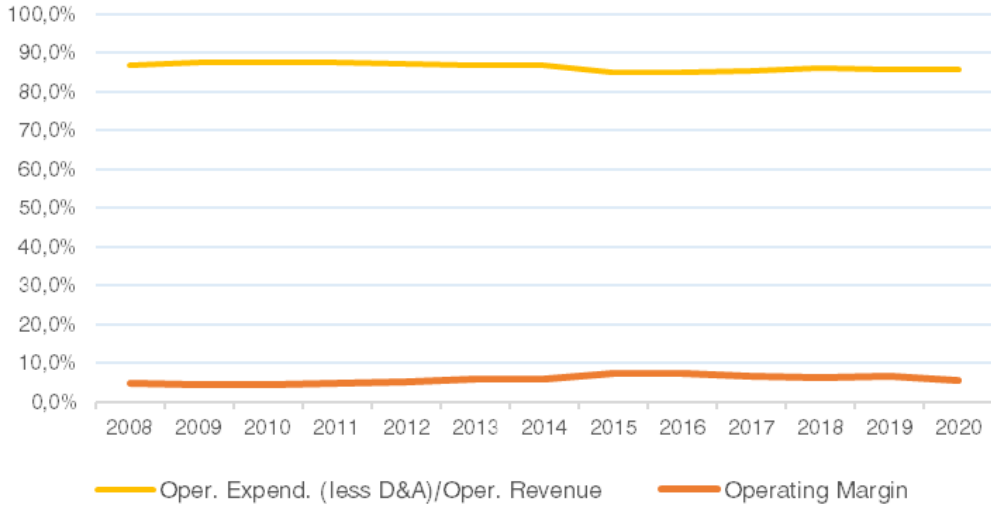
Figure 10. Sector H - Transport, ...
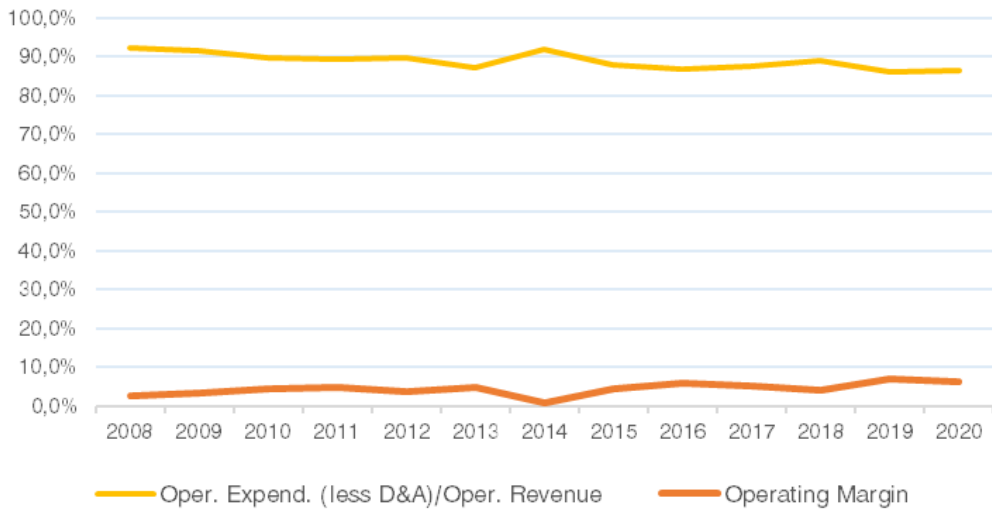**Source:** National Institute of Statistics, Own analysis
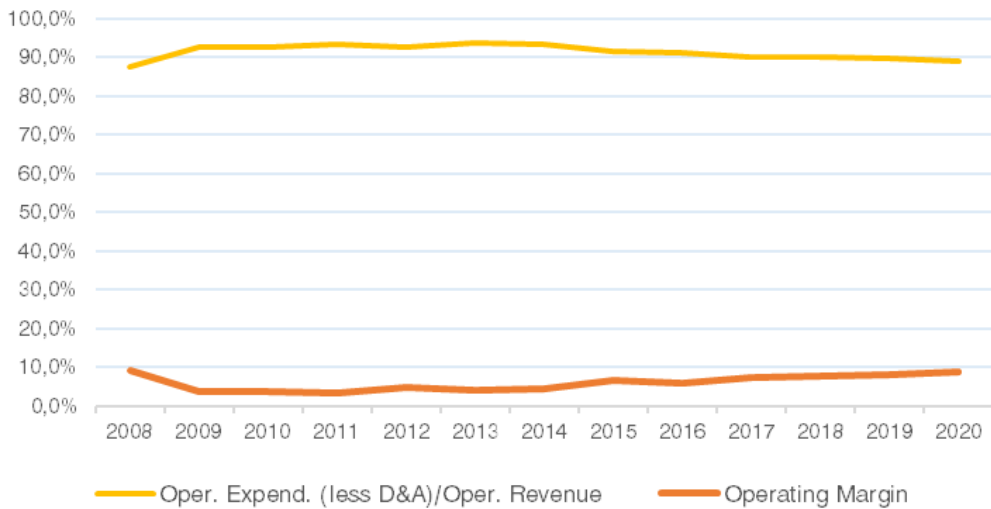
Figure 11. Sector F - Construction
Source: National Institute of Statistics, Own analysis

Figure 12 (Sector D – Energy) illustrates a little bit different picture. The lines are not so smooth and the deviations from the mean look higher. There is also a slight trend of decreasing operating expenditures (as percentage of sales) and an increasing operating margin. After the years of the global financial crisis the sector has been continuously improving its efficiency, as presented by the operating margin. Despite the higher volatility, it looks like that the historic average of the sector can still be a good starting point for projecting future operating expenditures. Of course, other relevant information about the prospects of the respective company should also be incorporated for the further refine of the forecast.

Figure 12. Sector D - Energy
Source: National Institute of Statistics, Own analysis

The numbers behind the operating expenditures (less D&A) lines in figures 8, 9, 10, 11, and 12 are presented in Table 2 (again by order of size). The average percent of operating expenditures (less D&A) for the period, for sector G, is 95,4%. The lowest value is 94,1%, the highest is 96,5%.

Table 2. Operating expenditures (less D&A) as percent of revenue for the 5 largest sectors

Year	Sector G	Sector C	Sector F	Sector H	Sector D
2008	94,1%	92,4%	87,6%	86,8%	92,3%
2009	95,9%	91,3%	92,6%	87,5%	91,4%
2010	95,9%	91,3%	92,6%	87,5%	89,8%
2011	96,5%	91,3%	93,3%	87,4%	89,4%
2012	96,3%	91,6%	92,6%	87,3%	89,9%
2013	96,1%	92,2%	93,7%	86,9%	87,4%
2014	95,7%	91,1%	93,3%	86,8%	91,8%
2015	95,0%	89,4%	91,4%	84,9%	88,0%
2016	95,0%	87,5%	91,2%	84,9%	86,7%

Year	Sector G	Sector C	Sector F	Sector H	Sector D
2017	94,9%	88,0%	90,1%	85,5%	87,5%
2018	95,1%	89,7%	90,0%	86,3%	88,8%
2019	94,9%	89,5%	89,6%	85,9%	86,3%
2020	94,3%	89,0%	89,1%	85,9%	86,4%
Average	**95,4%**	**90,3%**	**91,3%**	**86,4%**	**88,9%**
Minimum	**94,1%**	**87,5%**	**87,6%**	**84,9%**	**86,3%**
Maximum	**96,5%**	**92,4%**	**93,7%**	**87,5%**	**92,3%**

Source: National Institute of Statistics, Own analysis

The numbers behind the operating margin lines in figures 8, 9, 10, 11, and 12 are presented in Table 3. For sector G the operating margin is with an average of 3,5%, the minimum value is 2,3%, the maximum is 4,6%. Sector C has a higher operating margin, with an average of 5,6%. The spread is also higher, with the minimum value of 3,2% and the maximum value of 8,2%. Sectors F and H have the highest operating margins – 6,0% and 5,9% respectively. Not surprisingly, sector D has the highest spread between maximum and minimum – 6,4% percentage points.

It should be noted that operating expenditures (less D&A) and operating margin do not add up to 100% of operating revenue, because D&A expenditures are not included anywhere.

Table 3. Operating margin for the 5 largest sectors

Year	Sector G	Sector C	Sector F	Sector H	Sector D
2008	4,6%	3,2%	9,3%	4,9%	2,5%
2009	2,8%	4,2%	3,6%	4,7%	3,3%
2010	2,8%	4,2%	3,6%	4,7%	4,4%
2011	2,3%	4,9%	3,5%	5,0%	5,0%
2012	2,6%	4,8%	4,8%	5,3%	3,7%
2013	2,9%	4,2%	4,0%	5,9%	4,9%
2014	3,3%	5,2%	4,6%	5,9%	0,8%
2015	4,0%	6,6%	6,6%	7,5%	4,6%
2016	4,0%	8,2%	6,0%	7,3%	5,8%
2017	4,1%	7,9%	7,4%	6,8%	5,4%
2018	3,9%	6,2%	7,6%	6,3%	4,2%
2019	4,0%	6,3%	8,0%	6,5%	7,2%
2020	4,5%	6,3%	9,0%	5,7%	6,3%
Average	**3,5%**	**5,6%**	**6,0%**	**5,9%**	**4,5%**
Minimum	**2,3%**	**3,2%**	**3,5%**	**4,7%**	**0,8%**
Maximum	**4,6%**	**8,2%**	**9,3%**	**7,5%**	**7,2%**

Source: National Institute of Statistics, Own analysis

It has to be considered that one of the reasons for the relatively smooth lines in the figures are the aggregate values by sectors. The individual fluctuations by enterprises, which are often different in size and in opposite directions, have a compensating effect for the

aggregate numbers of the sector as a whole. They offset each other to a certain degree. The analysts should be aware, when using historic operating expenditures (less D&A) as percentage of operating revenue, that for many individual companies they would be more heterogeneous.

The above lines and values indicate that the historic average for operating expenditures as percent of revenue is a good starting point for making projections on future operating expenditures. The above average values by sectors can be used as benchmarks when making projections for the operating expenditures or the operating margins, when valuing a company in the respective sector. It is important to have such benchmarks for the industry in which the valued enterprise operates. Notwithstanding the temporary high or temporarily low levels of the operating expenditures (less D&A), they gravitate around the mean in the medium and long term. Sooner or later, for most companies, they revert to sector/industry average values. For some companies and industries, the costs and margins series seem more stable, and the analysts feel more confident with their projections. But even when operating expenditures and profit margins are more volatile, this should not be considered an issue, since for the sake of forecasting, the average values and the trends in the mid-term and long-term are the ones that matter.

Conclusion

The empirical study on the basis of the data about the non-financial corporations confirms this part of the main hypothesis, which states that there is significant interrelation between the dynamics of operating revenue and operating expenditures in the medium term and the long term. Notwithstanding the variations on an annual basis, the overall trends of revenue are closely followed by the trends of operating expenditures.

The historic values of operating expenditures, expressed as a proportion (as percent) of operating revenue are reliable benchmarks, which can be used for the forecast of future operating expenditures. This is a good argument in support of the approach to project future operating expenditures - the second input variable for determining future cash flows, as percent of projected operating revenue.

The contribution of the research to the theory and praxis is related to the preparation of such a large-scale analysis based on a large number of Bulgarian non-financial corporations (more than 180 000) for the period of 13 years (2008-2020). The links between total revenue and operating expenditures are sought. There is no such study in Bulgaria. Despite a thorough review of the literature on the subject, there is no such type of research internationally.

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